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## Knife Action and Storage Loosen Bark on

## Ponderosa Pine Pulp Chips

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Utilization of chippable sawmill residues and forest residues from logging and precommercial thinnings in the Black Hills of South Dakota and elsewhere could be greatly increased if an effective, economical way could be found to remove bark from ponderosa pine chips.

Recent developments in this field have shown promise,<sup>2 3 4</sup> but complete separation of bark from wood has not been achieved. An exploratory study was therefore conducted to find out whether storage and moisture would cause an appreciable loosening of bark on ponderosa pine pulp chips.

Highlights of the results showed that between 92 and 93 percent of the bark was loosened in the chipping process. The most

effective of the conditions studied loosened about a quarter of the remaining bark.

## PROCEDURES

As chips from unbarked residues were not available in the area, it was necessary to produce some especially for the study at a chip plant in Custer, South Dakota. Unbarked slabs, edgings, and precommercial thinnings were chipped during August 1962 with a 16-knife Norman chipper. Chips were fractioned into various sizes with a standard laboratory chip screen for physical analysis (table 1).

The chips were then separated into three groups of samples of four each of equal weight for storage at different moisture contents. Samples were adjusted to moisture contents of 17, 38, and 54 percent,<sup>5</sup> and then stored in polyethylene bags at 80°F.

Bark loosening was measured after storage periods of 2, 4, 6, and 8 weeks. After each

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<sup>2</sup> Wesner, Adam L. Part I. Vac-Sink for recovery of pulpwood chips from wood-bark waste. *Pulp & Paper* 36: 61-65, Aug. 20, 1962.

<sup>3</sup> Jarman, G. W. Methods of bark separation. *Northwest Wood Util. Council Bul.* 39. 1952.

<sup>4</sup> Eberhardt, L. Removal of bark from chips and wood pulp. *Paper Trade Journal* 135(25):23-24, 26, 28, 30. 1952.

<sup>5</sup> Moisture content based on green weight to conform with standard practice in the pulp and paper industry. When based on oven-dry weight, moisture contents were 20, 60, and 120 percent respectively.

Table 1.--Physical analysis of pulp chips from unbarked ponderosa pine slabs, edgings, and precommercial thinnings

Screen size (Inches)	Loose bark	Tight bark	Total bark	Total wood	Bark and wood
----- Percent <sup>1</sup> -----					
<u>SLABS AND EDGINGS</u>					
1	1.14	0.52	1.66	7.35	9.01
3/4	3.46	.97	4.43	9.86	14.29
1/2	4.32	.18	4.50	24.59	29.09
3/8	2.81	.03	2.84	18.01	20.85
3/16	6.19	.02	6.21	13.57	19.78
Through 3/16	5.32	--	5.32	1.66	6.98
Total	23.24	1.72	24.96	75.04	100.00
<u>PRECOMMERCIAL THINNINGS</u>					
1	--	.06	.06	.39	.45
3/4	.51	1.27	1.78	15.96	17.74
1/2	2.83	.31	3.14	27.03	30.17
3/8	2.85	.13	2.98	19.16	22.14
3/16	6.43	.03	6.46	14.07	20.53
Through 3/16	7.81	--	7.81	1.16	8.97
Total	20.43	1.80	22.23	77.77	100.00

<sup>1</sup> Based on oven-dry weight of wood and bark.

storage period, chips were shaken 10 times in a 1-gallon can to simulate the handling they are normally subjected to in conveyors and blower systems, so as to free any bark that might have loosened during storage.

The loose bark was then removed, and tight bark remaining on the chips was separated from the wood by hand. These three fractions (two bark, one wood) were weighed immediately and again after they were oven-dried. Amounts of loose and tight bark were

expressed as percentages of the total oven-dry weight of bark (table 2). Specific gravity of the chips in each sample was also determined for each moisture content and storage period.

## RESULTS AND DISCUSSION

The most significant finding of the study was that almost all of the bark was loosened in the chipping process. Results showed that 93 percent of the bark on slabs and edgings

Table 2. --Percentage of tight bark loosened from chips after 2 to 8 weeks' storage at various moisture contents

Moisture content <sup>1</sup> (Percent)	Slabs and edgings		Precommercial thinnings	
	Length of storage	Tight bark loosened	Length of storage	Tight bark loosened
	<u>Weeks</u>	<u>Percent<sup>2</sup></u>	<u>Weeks</u>	<u>Percent<sup>2</sup></u>
17	2	2.64	2	1.97
	4	4.13	4	4.44
	6	4.39	6	2.54
	8	2.72	8	1.25
38	2	.43	2	1.65
	4	4.06	4	4.37
	6	2.30	6	4.33
	8	2.10	8	4.81
54	2	7.44	2	6.16
	4	20.81	4	9.68
	6	23.39	6	11.87
	8	20.90	8	17.82

<sup>1</sup> Moisture content based on green weight.

<sup>2</sup> Based on oven-dry weight of total bark in sample; 100 percent loose bark would mean that all chips are bark-free.

and 92 percent in the case of precommercial thinnings was loosened by the mechanical action of the chipper knives.

None of the storage conditions investigated proved very effective. The best of these--storage at 54-percent moisture content for a minimum of 4 weeks in the case of chips from slabs and edgings, and 8 weeks for chips from precommercial thinning--accounted for the loosening of about one-fifth of the remaining bark (table 2). This would be equivalent to about 2 percent of the total bark content.

Analysis of variance showed that both storage time and moisture content affected bark loosening. However, any appreciable effects required a minimum of at least 4 weeks

at 54-percent moisture content (table 2). Storage for periods longer than 4 weeks did not appear to cause any further bark loosening in chips from slabs and edgings.

All the chips showed extensive blue stain after 4 weeks' storage, but analysis of variance of average specific gravity showed no significant change even after 8 weeks of storage.

Total bark content, about the same for both types of chips, made up about 25 percent of the total volume in slabs and edgings and about 22 percent in precommercial thinnings. The total tight bark content, or that remaining after chipping and storage, was also very similar, and accounted for almost 1.7 and 1.8

percent of the total volume, respectively. Most of the tight bark was on the chips retained in the 3/4-inch screen (table 1).

### CONCLUSION

In view of the high percentage of the total bark content that is loosened in the chipping of ponderosa pine sawmill residue and pre-commercial thinnings, the problem of bark

removal may not be so important as first thought. It is likely that an even higher percentage of the bark would be loosened if the material were chipped during the active growing season. Elimination of the need for complete debarking would greatly enhance the utilization of precommercial thinnings because of the high costs involved in handling the material. The acceptable levels of bark content, however, must be determined by the pulp and paper processing industry.